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Crystals Isolated at Princeton Believed Unseen Disease Virus

*Plant Organisms So Tiny They Seep Through Porcelain and Defy
Microscope Produced as Infection-Duplicating Protein*
by Dr. W. M. Stanley of Rockefeller Institute.

The isolation of a crystalline protein which possesses the properties of a virus and, by its action, is believed to be the virus itself made tangible and visible for the first time, is announced in the current issue of Science by Dr. W. M. Stanley of the Princeton station of the Rockefeller Institute for Medical Research.

The virus family is one of the intangible, will-o'-wisp of science. They are micro-organisms, so small that even the most powerful microscope is incapable of seeing them. They pass through the pores of porcelain filters that arrest ordinary bacteria. Yet small as they are, they are known to be the causes of some of the deadliest diseases of man, animal and plant, including infantile paralysis, encephalitis, measles, yellow fever, smallpox, rabies, parrot's fever and even the common cold.

While no one had hitherto ever seen any of these various filterable viruses, each of which is specific as to the disease it produces, their existence has been definitely dem-

onstrated by the action of fluid extracts taken from sick humans, animals and plants. In each case the extract when injected into a healthy animal or plant produces the same disease which had afflicted the subject it was taken from.

Dr. Stanley has succeeded for the first time in obtaining a tangible visible substance which produces a disease in a plant that hitherto could not be produced except by an extract taken from plants afflicted with a disease known to be due to an invisible "ghost" substance, or virus. This, therefore, marks the first scent on the trail of one of the "big game hunts" of science, and may mean that the road has at least been opened for the similar isolation of the deadly viruses that attack men.

The substance isolated by Dr. Stanley duplicates the tobacco disease known as tobacco-mosaic. It was known to be caused by a virus because the disease could be duplicated at will by injecting extracts

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CRYSTALS OF VIRUS FINALLY ISOLATED

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from tobacco leaves having the disease into healthy tobacco leaves.

So powerful is the crystal of the protein isolated by Dr. Stanley, he reports, that one cubic centimeter of a dilution containing one part in 1,000,000,000 proved infectious.

"The crystals," he added, "are a hundred times more active than the suspension made by grinding up diseased Turkish tobacco leaves, and about a thousand times more active than the twice-frozen juice from diseased plants.

"The infectivity, chemical composition and optical rotation of the crystalline protein were unchanged after ten successive crystallizations in a fractional crystallization experiment the activity of the first small portion of crystals to come out of solution was the same as the activity of the mother liquor."

The crystalline material contains 20 per cent nitrogen and 1 per cent ash, Dr. Stanley reports. To date a little more than ten grams of the active crystalline protein have been obtained. The crystals are small needles about three-hundredths of a millimeter long.

Mystery Near Solution.

"Although it is difficult, if not impossible," Dr. Stanley states, "to obtain conclusive proof of the purity of a protein, there is strong evidence that the crystalline protein herein described is either pure or is a solid solution of proteins."

This evidence gives the first definite indication of what viruses are made of. Hitherto it has been one of the great mysteries of science as to whether a virus was a living or non-living entity. A crystalline protein belongs to the non-living class, as it is incapable of growth and reproduction as living things are.

"Tobacco-mosaic virus," Dr. Stanley adds, "is regarded as an auto-catalytic protein which, for the present, may be assumed to require the presence of living cells for multiplication." A virus, according to this conception, would thus be an organism on the very border-line of the living and non-living, which can assume qualities of the living by coming in contact with living cells.